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ABSTRACT: The Female Athlete Triad: Prevalence in Military Women
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The female athlete triad, otherwise known as the inter-relatedness of disordered eating, amenorrhea, and osteoporosis, is an area of increasing awareness in female athletes, which has not been explored in military women. We conducted a 3 part prospective cross-sectional study to define the prevalence of eating disorders, menstrual irregularities, and the full female athlete triad in military women. A total of 423 female soldiers from the general active-duty population completed Part 1 which included the Eating Disorder Inventory (EDI). Any woman meeting the screening criteria for being "at risk" (AR) for abnormal eating behaviors underwent a clinical interview to determine whether or not they had a true eating disorder (ED). Of the 423 women who participated, 33.6% (n=142) met the screening criteria for being AR for an eating disorder with 33 women (8%) actually meeting the criteria for an ED. Part 2 of the study, consisted of a clinical evaluation and laboratory studies of any woman with menstrual irregularities (MI). Including all women, 9% had amenorrhea, 6% oligomenorrhea, and 12% had onset of menarche older than 14 years of age. Excluding all women on hormonal birth control, the prevalence dropped to 2.1%, 3.3%, and 9.2% for amenorrhea, oligomenorrhea, and menarche older than age 14 respectively. Of the women not on hormonal birth control, only 1% had both an ED and MI, and 3.5% of women AR also had MI. Part 3 of the study evaluated the bone mineral density (BMD) of all women from Parts 1 and 2 using dual energy x-ray absorptiometry (DEXA). There was no significant difference between the BMD of the femoral neck or the lumbar spine of 32 eumenorrheic controls with no abnormal eating behaviors and subjects with either MI, ED, or AR alone. Looking at those women with 2 variables, no women with both an ED and MI had the full triad who were not on hormonal birth control. There were 7 women in the AR group with MI who had a BMD of the femoral neck or spine −1.0 S.D. below the mean of the control group. This cross-sectional sample of female army soldiers demonstrated a significant prevalence of ED, but did not show a high prevalence of the full female athlete triad. Given that components of the triad are present, attention should be directed at preventing progression of the problem.

FOREWORD

Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the U.S. Army.

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Tamara Lauder
Principal Investigator's Signature

28 June 1997
Date

Principal Investigator: Tamara D. Lauder
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INTRODUCTION

Nature of the Problem

An area of increased awareness is described in the literature as the *female athlete triad*. This refers to the inter-relatedness of disordered eating, amenorrhea, and osteoporosis.[1-10] The *female athlete triad* carries with it a significant morbidity and mortality. For non-athletes, 50% of women treated for eating disorders do well; 30% have some improvement, but struggle with weight, body image, and relapses; and 20% do poorly.[11,12] The reported mortality rate in treated anorectic women has been up to 10% to 18%.[12-14] The prevalence of amenorrhea ranges from 3.4% to 66% in female athletes.[15-21] The relationship between menstrual irregularities and decreased bone mass in women athletes has been reported in a number of studies.[22-39] Amenorrhea in this group of females has been associated with decreased bone mineral density and premature osteoporosis[22-27,29-35,39] putting them at an increased risk for stress fractures and premature osteoporotic fractures.[26,29,31,36,40-44] The protective effect that exercise has on vertebral bone maintenance, seems to be lost when women exercise to the point of developing amenorrhea.[22,24] LLoyd et. al.[28] found nearly a four times increase in frequency of stress fractures in women with irregular menses compared to the group of women with regular menses.

The risk profile of those who develop the *female athlete triad* are: involvement in sports where a low body weight and lean physique is an advantage; involvement in individual sports; and those who receive pressure and have the desire to optimize performance and maintain a certain weight requirement.[1,3,45-51] Active duty military females are subjected to high physical fitness requirements, weight restrictions, and are under the auspices of pressure from higher ranking individuals in charge to improve performance. Failure to meet the weight requirements set out by the Army can result in loss of their career, opportunities for education, and retirement. Active duty soldiers often do not have control over their diet. In many situations, they have access to only what is provided for them, which often is food high in calories and fat. In this respect, they are under similar pressures as other female athletes and are therefore at risk for the physical and psychological consequences of the *female athlete triad*, which can affect both their health and work performance. Although no studies have addressed the full *female athlete triad* in military women, components of the triad have been looked at.

The primary objective of this study was to determine the prevalence of pathologic eating behaviors, menstrual irregularities, and the full *female athlete triad* in military women. The *female athlete triad* needs to be recognized in military women so that efforts can be initiated for awareness, prevention, and treatment of an entity, which carries with it a significant morbidity and mortality.

Background

In 1972, Title IX of the Education Amendments Act prohibited gender discrimination in the provision of educational programs and activities for all secondary and post-secondary educational institutions receiving federal funds. Despite the fact that numerous surveys reveal that educational institutions have been noncompliant with Title IX, there has been an increasing awareness of women in sports in the last 2 decades.[52] In 1976, women were first admitted into military academies. The specific objective of academy training did not change when women entered the environment and consisted of a high level of academia, professional development, and physical fitness. Men and women are expected to expend the same relative effort in all training.[53-55]

For most females involved in athletics, there are significant health benefits associated with participation in physical activity. Some women, however, develop one or more of several medical problems; disordered eating, amenorrhea, and osteoporosis. This is better known in the literature as the *female athlete triad* and carries with it a significant morbidity and mortality. In 1992 and 1997, the American College of Sports Medicine (ACSM) convened with a panel of experts in order to develop an action plan for better prevention, assessment, and treatment.[2,3] In 1993, the Eating Disorders Information and Education Act was incorporated in the Women's Health Equity Act with the purpose of providing information and education on the prevention and treatment of eating disorders and subsequent medical problems.[1]

Female athletes are under a great deal of pressure to perform as well as their male counterparts, as well as to achieve the sociocultural ideal of physical perfection. There is evidence that such pressures may lead to the development of abnormal eating behaviors.[56,57] The prevalence of abnormal eating behaviors in female athletes has been reported as 15% to 62%.[45,46,50,51,58] Anorexia nervosa and bulimia nervosa have been described as two extreme entities in a spectrum of eating disorders. Many athletes engage in pathologic eating and weight control behaviors putting them at risk for physical and psychological problems, but do not fit the full DSM IV criteria for anorexia or bulimia.[4,11,13,59-61] The prevalence of anorexia nervosa and bulimia in the general female population using strict DSM IV criteria is 1% and 1% - 3% respectively as of 1994.[59] Beals and Manore[62] discuss the idea that many athletes exhibit "subclinical " forms of eating disorders that meet some, but not all of the formal diagnostic criteria. Pugliesi[63] describes a form of subclinical anorexia in athletes called "anorexia athletica", which has been referred to further.[50]

Menstrual cycle irregularities and late menarche have been frequently reported in women who vigorously exercise and have been referred to as "exercise-induced".[6,15,64-69] Amenorrhea is also one of the diagnostic criteria in anorexia nervosa and has been reported in women with low-body weight and body fat.[41,70-72] Although the exact etiology is

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unclear, most data implicates that "exercise-induced" menstrual cycle changes are multifactorial in nature, involving proposed hypothalamic dysfunction, physical exertion, psychological stress, nutrition, body weight, and body fat.[15,16,20,21,38,39,66,67,73-76]
Lindberg et. al.[77] did find however, that female runners who decreased their mileage by 43%, increased their body weight 5%, resumed their menses, and increased their bone mineral density (BMD). Drinkwater et al. found similar results.[78]

The prevalence of amenorrhea in the athletic population ranges from 3.4% to 66% compared to 2% to 5% in the general female population.[15-21] Several authors summarize the multiple different definitions for amenorrhea, which may account for the wide range in reported prevalence.[16,74,79] Exercise-induced amenorrhea has been reported in women performing a number of different sporting events although most frequently reported in runners.[6,19,21,74] Many authors have looked at the effect of distance and intensity, but both have been found to vary extensively among individuals.[21]

The prevalence rate of premature osteoporosis in the female athlete is not known, although the relationship between amenorrhea, oligomenorrhea, late menarche, and decreased bone mineral density in this population has been well documented.[22-27,29-35,38] The association with low bone mineral density has also been described in anorexia nervosa and is similar to that seen in amenorrheic athletes.[41,71,80] The prevalence of the *female athlete triad* is not known as there is a lack of data in this area.

Military personnel, in reality, are all athletes, having the pressures to maintain a high level of fitness for many duty requirements, army physical fitness and readiness training, and the army physical fitness test. They also have the pressures of weight requirements and performance measures for career development. Studies looking at women at the US Military Academy at West Point, New York found that in the class of 1980, 74% of the women surveyed developed secondary amenorrhea during their first year at the academy and that the incidence of stress fractures was 1% for men and 10% for women. In 1990 and 1991, after changes were incorporated into the training to help reduce these problems, menstrual irregularities remained high at 72% and 68% respectively and the rate of stress fractures remained greater for women at 0.5% for men and 5.1% for women.[53] In his review of stress fractures, Jones et. al.[81]point out the increased incidence of stress fractures in military women. Numerous other studies have found that musculoskeletal injuries occur more frequently in females, with reported incidences of lower extremity injuries occurring in 20% to 30% of males compared to 40% to 60% of females.[82] The most frequent injury sites have been reported as the foot, ankle, and the knee with stress fractures being a common injury in females.[53-55,83-88]The consequences of such injuries are increased time away from full duty requirements in women compared to men.[84,86,87]

It wasn't until recently that abnormal eating behaviors were reported in the military population. Peterson et al.[89] looked at bulimic weight-loss behaviors in males and females in a military weight-management program and compared them to 2 groups of individuals. They compared them to a group of military personnel who were not in a weight-management program and to a group of civilians who were enrolled in a weight-loss

program. They found that military personnel in the weight-management program reported bulimic behaviors 2-5 times more than did the military comparison group not in a weight-management program, on 5 of 7 weight loss behaviors and 4 times more than the civilian weight-loss program participants on 3 of 7 behaviors. Davis et al.[90] looked closely at eating disorder patients and found 60% were competitive athletes prior to the onset of their disorder, and 60% reported that sport or exercise pre-dated their dieting. It is possible that a fair number of women are more athletically inclined than the general population, giving them the interest to join the armed forces.

Purpose

Because of the physical requirements for all active duty military personnel, we assumed that all potential participants were athletes. It was our hypothesis that pathologic eating behaviors and the full *female athlete triad* does exist with a significant prevalence in the female military population, as they are a population with multiple risk factors.

Methods of Approach

Part 1: To determine the prevalence of pathologic eating behaviors in the female military population at Ft. Lewis, WA using questionnaires and personal interviews.

Part 2: To determine the incidence of menstrual cycle irregularities in military women. To differentiate the diagnosis of exercise-induced amenorrhea or oligomenorrhea from other causes of secondary amenorrhea or oligomenorrhea in those women recognized from Part 1 having pathogenic eating behaviors or eating disorders. This was accomplished using clinical evaluation, laboratory workup, and other diagnostic studies as needed.

Part 3: To perform bone densitometry of the lumbar vertebral column, femur, and total body on all subjects from Part 1 and/or Part 2. Subjects with low bone mineral density, compared to control subjects, will be used in determining the prevalence of the full *female athlete triad*. Subjects on injectable medroxyprogesterone also received bone densitometry.

BODY

METHODS

A prospective three-part prevalence study was carried out on active duty females at Ft. Lewis and Madigan Army Medical Center, Tacoma, WA.

PART 1

Eating Disorder Inventory

Part 1 of the study, looked at the prevalence of abnormal eating behaviors with the use of the Eating Disorder Inventory (EDI). Questionnaires were administered to active duty females of selected field units on Ft. Lewis Army Post after a brief educational session about the study. At Madigan Army Medical Center notification of the study was distributed through the hospital computer system, written notification around the hospital, and group meetings on the hospital wards and clinics. All questionnaires were completed on a volunteer basis.

The Eating Disorder Inventory (EDI) is a widely used self-report measure of symptoms commonly associated with eating disorders, but is not a diagnostic questionnaire. The EDI consists of two separate sets of questions. The EDI symptom checklist (SC) provides information regarding the frequency of specific eating behaviors such as binge eating, self-induced vomiting, use of laxatives, diet pills, diuretics, as well as exercise patterns and data regarding weight, weight history, and menstrual history. The EDI 2 consists of 11 subscales concerning attitudes and behaviors concerning eating, weight, and shape as well as psychological traits clinically relevant to eating disorders.

The EDI was used as an initial screen for pathogenic eating behaviors and symptomatology. A set of screening criteria was chosen (based on information from other studies in the literature)[45,46,50,91] to define those women at risk for abnormal eating behaviors. The screening criteria defining the at-risk population consisted of: those women indicating bingeing, purging, use of laxative, diet pills, or diuretics greater than one time per month for three months, or greater than two times per week at their worst in the last two years on the EDI-SC questionnaire; or having a drive for thinness (DT) score of 14 or greater, bulimia (B) score of 10 or greater, or a body dissatisfaction (BD) score of 16 or greater, associated with a low body mass index (BMI) of less than 21.0 kg/m^2 on the EDI 2. The EDI subscale scores that we used were based on the mean scores of DT, B, and BD for known eating disorders as described in Garner's manual.[91] Normative standards for BMI are based on the National Health and Nutrition Examination Survey I and II.[92] All women who met the screening criteria, received a clinical interview.

Clinical Interview

A single investigator who was not blind to the subject's questionnaire information did all interviewing of subjects. Each interview lasted from 30 to 60 minutes. Besides pursuing

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information about the subject's eating behaviors based on their answers from the EDI, the interview also addressed exercise and menstrual history based from a number of questions modeled after the Michigan State University Weight Control Survey with the permission of Gail M. Dummer, PhD - assistant professor in the School of Health Education, Counseling Psychology, and Human Performance at Michigan State University. This particular questionnaire has been used in numerous prevalence studies for eating disorders in a variety of athletes. Many questions were modified to make their use more appropriate for a military setting.

Each subject who met the screening criteria was interviewed and categorized into one of the following: (1) No eating disorder (At Risk (AR) population) (2) Anorexia nervosa (AN) DSM IV 307.1 (3) Bulimia nervosa (BN) DSM IV 307.51, (4) Binge (BED) eating disorder, (5) Eating disorder NOS (EDNOS) DSM IV 307.50, (6) Situational eating disorder (SITED). A situational eating disorder is a subcategory of EDNOS which was created for our population of subjects and is defined as follows: any female with symptoms that do not meet the diagnostic criteria of anorexia nervosa, or bulimia nervosa that has recurrent episodes of abnormal dieting/eating behaviors such as self-induced vomiting, strict dieting, fasting, laxatives, diet pills, or other ways of losing weight; such behaviors are associated with external pressures that occur in the military when anticipating weigh-ins or army physical fitness testing (APFT); and such behaviors are associated with significant distress or judged as abnormal, dangerous, or may cause adverse physical symptoms. Any subject which met one of the DSM IV criteria for an eating disorder or met the criteria for BED, or SITED were collectively defined as the Eating Disorder group (ED).

In addition to the above 423 active duty participants, we were able to obtain the participation of 310 Reserve Officer Training Camp (ROTC) cadets during the June 1996 ROTC advanced camp, which takes place at Ft. Lewis, WA. Due to the demands of the cadet's training schedule, they were only able to complete the EDI questionnaire and were not able to participate in an interview, Part 2 or Part 3. The results of their answers on the EDI will be reported, as well as compared with the active duty population.

PART 2

Gynecological Interview and Examination

Part 2 of the study, was designed to look at those individuals with abnormal menstrual cycles. Any female with amenorrhea, oligomenorrhea, or menarche later than age 14, with or without an eating disorder from Part 1, proceeded to Part 2 of the study. We also looked at women on injectable medroxyprogesterone to evaluate the affect of progesterone-only agents on bone due to it's side affect of amenorrhea in many users. Women with oligomenorrhea were included, as this has been suggested to also be a risk factor for premature osteoporosis.[35] Ongoing pregnancy was an exclusion criterion for going on to Parts 2 and 3.

Part 2 consisted of a clinical history, pelvic examination, and a laboratory evaluation to determine the cause of the amenorrhea, determine if they had oligomenorrhea, and whether any subject was classified as having primary amenorrhea. The laboratory evaluation included: B-HCG, FSH, LH, TSH, and a prolactin level.[67,75,93-95] Any further diagnostic studies necessary to make a diagnosis were completed on an individual, as needed basis. "Exercise-induced" amenorrhea has been described as a subtype of hypothalamic amenorrhea, and all other causes must be excluded.[64,93,94,96]

Amenorrhea was defined as the absence of menses in a previously menstruating woman for a length of time equivalent of at least 3 previous cycle intervals[93,97] or 3 months[93]. Oligomenorrhea is defined as less than 9 menses in a 12 month time period. For the purposes of this study, we classified anyone with menarche at an age greater than 14 years of age, as the late menarche (LMENAR) group. These subjects were then interviewed to determine if they had primary amenorrhea (absence of menses and growth and secondary sexual characteristics by age 14).

Those individuals that fit the criteria for amenorrhea, oligomenorrhea, menarche later than age 14, with or without a pathogenic eating behavior, diagnosed in Part 1, were entered into Part 3. Women on injectable medroxyprogesterone also continued into Part 3.

PART III

Bone Densitometry

Part 3 of the study consists of dual energy x-ray absorptiometry (DEXA). DEXA scans were done of the following areas: lumbar vertebral column; femoral neck; and total body. Subjects participating in Part 3 included: any female with abnormal eating behaviors with and without amenorrhea, oligomenorrhea, or menarche greater than age 14; any female without abnormal eating behaviors with amenorrhea, oligomenorrhea, or menarche onset greater than 14 years of age; any woman on injectable medroxyprogesterone. Bone mineral density was determined based on comparisons with eumenorrheic female controls who participated in answering the questionnaire, but did not meet any of the screening criteria for being at risk for an abnormal eating behavior.

Follow Up

No follow up was needed on the subjects for purposes of the study. Any subject with pathogenic eating behaviors or eating disorders, menstrual cycle problems, or concerning low bone mineral density was referred for treatment as appropriate.

STATISTICS

The incidence of pathogenic eating behaviors, amenorrhea, oligomenorrhea, late menarche, and the full *female athlete triad* among military women was determined using the total number of subjects which completed and returned the questionnaire as a base. Chi-square was used to evaluate the relationship between nominal variables. The ANOVA was used to compare more than 2 groups for continuous variables. Follow-up testing was done using Fischer-PLSD to look at pairwise comparisons. Differences were considered statistically significant when P<.05. Analysis of covariates was used to evaluate the effect of eating disorders and menses on BMD, controlling for the effects of BMI, age, and race.

RESULTS:

TOTAL ACTIVE DUTY SUBJECTS: A total of 423 active duty female soldiers from the general active duty population at Ft. Lewis, WA participated in the study. Of those participating, 29% (n=123) were from the Army Medical Department (physicians, nurses, and technicians), and 71% (n=300) were from 7 different selected field units. The response rate for questionnaire completion was greater than 90% for most of the selected field units and approximately 25% for the medical personnel at the hospital. Racial distribution of the subjects was as follows: 57% (n=239) Caucasian; 27% (n=113) African-American; 7% (n=28) Hispanic; 3% (n=13) Asian; and 6% all others. Age range was from 17 to 53 years old, with a mean of 27.5 ± 7.7 years. The mean age of menarche was 12.7 ± 1.8 years with a range of 8 to 21 years. Eighty-seven percent of subjects experienced menarche at < 15 years of age.

ROTC CADETS: A total of 310 ROTC cadets volunteered to answer the EDI questionnaire. Racial distribution of 265 subjects who reported the information was as follows: 72% (n=190) Caucasian; 12% (n=33) African-American; 6% (n=16) Hispanic; 5% (n=13) Asian; and 5% all others. Age was significantly younger than the active duty population (p<.0001) ranging from 18 to 31 years with a mean of 21.5 ± 1.9 years of age. The mean age of menarche was 13 ± 1.5 years, ranging from 9 to 18 years. Eighty-seven percent of cadets also reported having menarche onset at < 15 years of age. Regarding menstrual cycles, 84% reported having regular periods one time a month, 12% reported skipping occasionally, and 5 % reported having a menstrual cycle only a few times per year. Of those that reported having a cycle only a few times per year, 5 were on injectable medroxyprogesterone. The ROTC group of subjects was not able to participate in Part 2, so the only available information regarding their menstrual cycles is from the EDI questionnaire.

PART I
Eating Disorder Inventory

A total of 423 active duty women answered the questionnaire. Several aspects of the EDI were evaluated and are described below. Of the 423 women, 33.6% (n=142) met the screening criteria for being at risk for abnormal eating behaviors and participated in a clinical interview. Of the 142 women who met the screening criteria, 33 had eating disorders (ED) and 109 were defined as being At Risk (AR) as they met the screening criteria but did not meet the criteria for an eating disorder (see graph 1). All women who did not meet the screening criteria (n=281) are defined as the negative screen group (NEGATIVE). In the descriptions below, information will be provided for the total group of subjects, after the subjects are divided into 3 groups, namely ED, AR, and NEGATIVE.
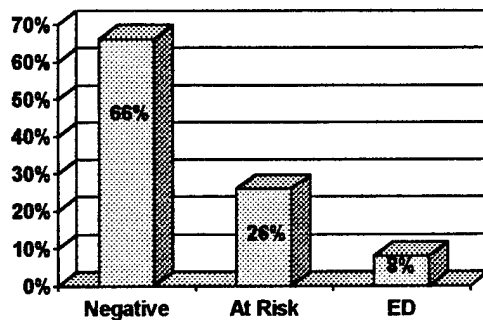
Graph 1: Percentages of total active duty women (n=423) that fell into the groups of interest.

Body Weight

TOTAL ACTIVE DUTY SUBJECTS: The mean reported weight and height for the total group of subjects (n=423) was 139.8 $\pm$ 20.4 lbs. and 64.6 $\pm$ 2.7 inches respectively. The mean reported Body Mass Index (BMI) was 23.5 $\pm$ 3.13 kg/m^2, median 23.2 kg/m^2 with a range of 16.3 to 42.6 kg/m^2. When subjects were asked what their ideal body weight (IBW) was, they reported a mean of 128 $\pm$13.8 lbs. Twenty-one subjects chose not to answer the question. Of the 402 subjects which did report their IBW, 7% (n=27) of subjects reported wanting to weigh exactly what they currently weighed, 9% (n=37) of subjects wanted to weigh more than their current weight, and 84% (n=338) reporting wanting to weight less than their current weight. Of the 338 subjects who reported wanting to weigh less, 50% of subjects wanted to weigh more than 10 lbs. less. All 27 subjects who were satisfied with their current weight, did not meet the screening criteria for an interview.

THREE GROUPS: Each of the ED, AR, and NEGATIVE groups were divided into two categories: those that were satisfied with their weight (desired weight was more than their current weight or up to 10lbs less) and those who were dissatisfied (wanted to weigh more than 10 lbs. less than their current weight). Weight satisfaction was significantly related to group designation (p=<.0001). Prevalence of weight dissatisfaction was highest in the ED group at 78%, 60% in the AR group, and lowest in the NEGATIVE group at 33% (see graph 2).

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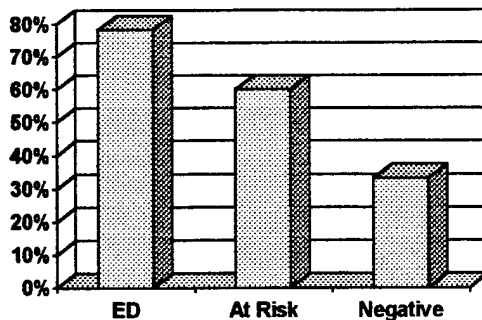
Graph 2. Prevalence of weight dissatisfaction in active duty female groups

ROTC CADETS: Mean reported height and weight was 64.7 ± 2.7 inches and 135.5 ±16.4 lbs. respectively. The mean BMI, based off their reported answers, was 22.7 ± 2.3 kg/m^2 with a range of 18.1 to 33.3 kg/m^2. Compared to the group of active duty soldiers, the ROTC group weighed significantly less and had a lower BMI (p<.003). Regarding the ROTC cadet's IBW, they reported a mean of 127.5 lbs. +/- 13.4 which was not significantly different than that reported by the active duty soldiers. For the 295 subjects which chose to answer the question, 6% (n=17) wanted to weigh the exact weight that they currently weighed, 9% (n=28) wanted to weigh more than their current weight, and 85% (n=250) wanted to weigh less. Of the 250 subjects that wanted to weigh less than their current weight, 38% (n=112) wished to weight more than 10 lbs. less.

Exercise

TOTAL ACTIVE DUTY SUBJECTS: Due to the many different types of activities that military women are involved in, exercise intensity was defined as the frequency of exercise multiplied by the duration in minutes of the average number of minutes that they sustain each type of exercise. In our subject sample, the mean exercise intensity was 282.0 ± 219.9 min/wk (4.7 hrs/wk ± 3.7) with a median of 240.0 min/wk with one subject having a maximal intensity of 1680.0 min/wk (28 hrs/wk). 214 (51%) women report doing > 50% of their exercise to control their weight, with 32 (8%) reporting that 100% of their exercise is for weight control.

THREE GROUPS: When the subjects were divided into three groups and compared, the women with ED exercised 1.5 to 1.7 times as much as women in the AR or NEGATIVE groups respectively (p=<0.0001) (see graph 3). The number of women that reported doing >50% of their exercise for weight control varied among groups, with 91% of women in the ED group, 64% in the AR group, and only 41% of women in the NEGATIVE group reporting such habits.

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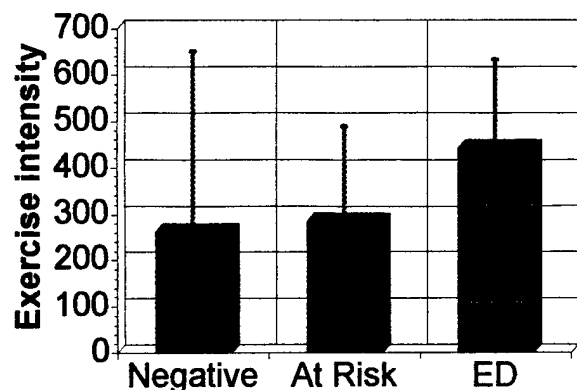
Graph 3: Exercise intensity of each active duty group of interest

ROTC CADETS: The mean exercise intensity for this group of women was 302.5 ± 219.8 min/wk (5.0 ± 3.7 hrs/wk) with a median of 270.0 min/wk and a maximum of 1260.0 min/wk (21 hrs/wk). Of the 298 women that answered the question, 138 (46.3%) reported that over 50% of their exercise is done to control their weight, with 6% (n=19) reporting 100% was to control their weight. Comparing ROTC to the total active duty population, exercise intensity was not significantly different between the 2 groups.

Body Image
TOTAL ACTIVE DUTY SUBJECTS: Three of the EDI subscales including DT, B, and BD were used in this study as part of the screening criteria for identifying women at risk for developing an eating disorder. The means of the subscale scores were as follows: DT= 4.9 ± 5.5; B= 1.5 ± 3.1; BD 11.4 ± 8.4. The mean score for the 8 original subscales of the EDI (DT, B, BD, I, P, ID, IA, MF) was 36.1 ± 27.4 and the mean of the total score for all 11 subscales was 46.9 ± 36.6. When looking at how many subjects had met our subscale screening criteria, 34 subjects had a DT score >14 (8% of total subjects and 24% of group that met screening criteria), 12 had a B >10 (3% of total, 8% of screens), and 7 subjects had both a BD score >16 and a BMI of <21.0 kg/m^2 (2% of total, 5% of screens). Sundgot-Borgen[50] defined her "at risk "group as those subjects who had a "high" DT and BD score and a total EDI score for the original 8 subscales of >39. In our population, 30 subjects (7% of total, 21% of screens) met all three criteria of a DT >14, BD >16 and a total EDI score (for 8 subscales) >39. Of the 30 subjects that met a similar criteria used by Sundgot-Borgen[50], 19 (63.3%) subjects fell into the AR group, 7 (23.3%) were in the ED group, and 4 (13.3%) in the NEGATIVE group.

THREE GROUPS: Subjects with ED had a significantly higher Drive for Thinness and Bulimia scores than AR or NEGATIVE and the AR had a significantly higher Drive for

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Thinness than NEGATIVE (p<.0002). When looking at Body Dissatisfaction, the ED and AR group had a significantly higher score than the NEGATIVE group (p<.0001), but there was no significant difference between the ED and AR group (see table 1). Total EDI scores for both the original 8 subscales and all 11 current subscales were evaluated. The 8 original subscales were evaluated so that our results might be compared with previous studies in the literature. There were significant differences between the three groups. The mean total 8 EDI subscale scores for the ED, AR, and NEGATIVE groups were 60.7 ± 22.9, 47.5 ± 24.0, and 28.8 ± 26.0 respectively. The mean 11 EDI subscale scores for the ED, AR, and NEGATIVE groups were 78.2 ± 30.4, 60.7 ± 31.7, 38.0 ± 35.5 respectively. All pairwise comparisons for both the 8 and 11 EDI subscale groups were significant.

EDI Subscales	ED	At Risk	Negative	P value
DT	11.4 ± 5.3	7.8 ± 6.0	3.2 ± 4.2	<.0001
B	5.0 ± 4.4	1.8 ± 2.6	1.0 ± 2.8	<.0001
BD	17.1 ± 7.3	16.0 ± 7.9	8.9 ± 7.7	<.0001

Table 1: EDI subscale scores for the 3 active duty groups

ROTC CADETS: The means of the subscale scores were as follows: DT 3.7 ± 4.9; B 0.7 ± 1.6; BD 8.7 ± 8.1. Compared to the total group of active duty women, the ROTC subjects had significantly lower means for all 3 of the subscale scores (p<.003). Of the total group of ROTC cadets, 18 (6% of total) had a DT score >14, none (0%) had a B > 10, and none (0%) had a BD score > 16 with a BMI of < 21.0. There were 62 (20%) women that would have met the screening criteria for an interview. The ROTC subjects that met the screening criteria for an interview has significantly higher DT, B, and BD scores than those that did not meet the screening criteria (see table 2).

EDI Subscales	Total ROTC	At Risk	Negative	P value
DT	3.7 ± 4.9	8.3 ± 6.8	2.6 ± 3.5	<.002
B	0.7 ± 1.6	1.5 ± 2.2	0.5 ± 1.3	<.0001
BD	8.7 ± 8.1	14.5 ± 8.8	7.2 ± 7.2	<.0001

Table 2: Mean EDI subscale scores for the total ROTC cadets, those that met the screening criteria for an interview (at risk), and those that did not meet the screening criteria (negative).

Clinical Interview

Of the 423 active duty women who answered the questionnaire, 33.6% (n=142) met the screening criteria for being at risk for abnormal eating behaviors. Of these 142 women, 108 were interviewed and 34 were lost to follow up due to deployments and had file reviews only. Out of the 108 women interviewed, 29 (27%) had ED and 79 (73%) remained in the AR group. Of the 34 subjects who did not receive interviews but had only file reviews, 4 (12%) admitted behaviors on their EDI significant enough to classify them in the ED group without knowing the psychological affect that they might have from their reported behaviors. The remaining 30 subjects (88%) who were not interviewed, remained in the AR group. Of the 33 women with ED, 1 woman had AN (0.2% of total), 3 BN (0.7%), 11 EDNOS (2.6%), 5 BED (1.2%), and 13 had SITED (3.1%)(see graph 4).
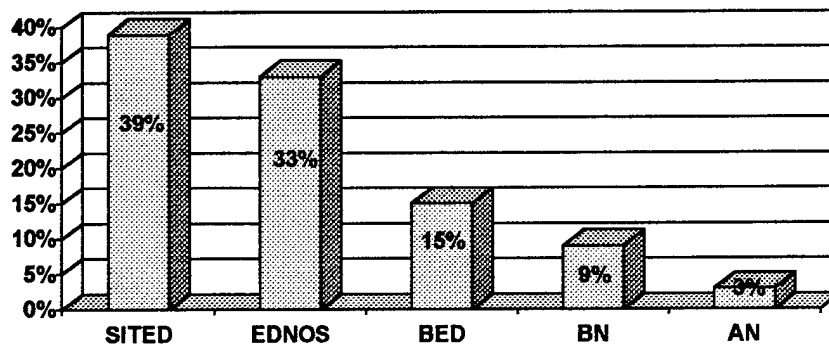
Graph 4: Percentages of individual eating disorders out of the 33 active duty subjects diagnosed with eating disorders

External Pressures

Feelings of pressure were measured on a five point scale based on the amount of pressure they felt about their weight, about the military environment, and about the Army Physical Fitness Test (APFT). Women were put into 2 groups according to the amount of pressure that they felt. Group 1 included those women that reported feeling no pressure or only minimal pressure, and group 2 included all women who reported a moderate to an extreme amount of pressure. For those women interviewed, the extent to which external pressures influenced their eating behaviors is illustrated in table 3. There was a larger proportion of women in the ED group who reported a large amount of pressure.

Pressure	ED	At Risk	p-value
Military pressure about weight	18/28 64%	25/76 33%	0.0039
Constant pressure about weight	13/28 46%	18/74 24%	0.0303
APFT pressure	16/27 59%	21/72 29%	0.0058

Table 3: The percent of active duty women in each group who reported in the interview as experiencing a great deal of external pressures that influenced their eating behaviors

PART II
Gynecologic Examination

Women were asked to participate in Part II if they had any of the following: menstrual irregularities suggestive of amenorrhea, or oligomenorrhea in the last 2 years; they were currently using injectable medroxyprogesterone; or if they experienced menarche at an age greater than 14 years of age. Out of 423 total women, 9% (n=36) of women had amenorrhea, 6% (n=24) had oligomenorrhea, and 12% (n=51) experienced menarche later than 14 years of age. Of those women with amenorrhea, 5 of them also had late menarche, and 6 women with oligomenorrhea also had late menarche. All women with either amenorrhea, oligomenorrhea, or menarche onset older than age 14, will be defined as the group with menstrual irregularities (MI). Of the total group of women with MI, 54 of the women did not meet the screening criteria for abnormal eating behaviors.

Diagnoses of menstrual cycle changes were based on results from history and physical examination, laboratory studies, and further workup as appropriate. The etiologies of amenorrhea varied as follows: only 2 were thought to have true exercise-induced amenorrhea, 1 hypothyroidism, 1 premature ovarian failure, 1 Turners syndrome, 2 had unclear etiologies, 5 were past injectable medroxyprogesterone users whose menses had not returned, 23 were currently on injectable medroxyprogesterone, and 1 currently on Norplant. Of those with menarche > 14 years of age, 16 (31%) fit the criteria for primary amenorrhea. One hundred and forty-three (35%) women reported missing their period for 3 months or greater at sometime during their lifetime.

Birth Control Pills/Injectable medroxyprogesterone Use

Those subjects in the MI group were divided into those who were currently using or not using BCPs or injectable medroxyprogesterone, based on the information collected at the time of their gynecological (GYN) examination. A total of 62 women with MI were not using any hormonal birth control. Of the women with amenorrhea, 9/36 (25%) were not using

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either BCPs or injectable medroxyprogesterone with 3/9 (33%) of those subjects having both amenorrhea and menarche > age 14. For the women with oligomenorrhea, 14/24 (58%) were not using either BCPs or injectable medroxyprogesterone with 3/14 (21%) having both oligomenorrhea and menarche > age 14. There was a total of 51 women who experienced menarche at an age older than 14, with 39/51 (76%) not using either BCPs or injectable medroxyprogesterone. There were 29 subjects of the total 423 subjects, using injectable medroxyprogesterone.

Affect of Basic Training on the Menstrual Cycle

There were 55 women who were questioned about their menstrual cycles during basic training. Of the 55 women whom the information was available, 67% (n=37) had experienced cessation of their menses during basic training.

Incidence of Two Variables- Abnormal Eating Behaviors and Menstrual Changes

There were 11 subjects who had both an ED and MI . Of those 11 subjects, 2 were on BCPs and 5 were on injectable medroxyprogesterone leaving only 4 subjects who were not on any hormonal birth control. There were 29 subjects who were both AR and had MI. Of the 29 AR subjects, 7 were on BCPs and 7 were on injectable medroxyprogesterone leaving only 15 subjects who were not on any hormonal birth control.

Of the women with an ED who were not on any hormonal birth control, they are divided as follows: ED + amenorrhea = 1; ED + amenorrhea and late menarche = 0; ED + oligomenorrhea = 1; ED + oligomenorrhea and late menarche = 0; ED + menarche > 14 = 2. Of the women who were AR who were not on any hormonal birth control, they are divided as follows: AR +amenorrhea = 2; AR + amenorrhea and late menarche =1; AR + oligomenorrhea = 6; AR + oligomenorrhea and late menarche = 0; AR + menarche >14 = 7

PART III
Controls

A group of 32 active duty women with no history or report of abnormal eating behaviors, no history of, or current menstrual irregularities, and not on any hormonal birth control, received a DEXA to assess bone mineral density. The mean age of the control group was 31.9 ± 7.8 with a range of 19 to 48 years. The mean BMI was 22.6 ± 2.7 kg/m^2. Racial distribution was 56% Caucasian, 31% African-American, 10% Hispanic, and 3% other. The mean BMD for the PA spine was $1.249 \pm .116$ g/cm^2 and for the femoral neck $1.011 \pm .119$ g/cm^2.

Dual Energy X-Ray Absorptiometry (DEXA)

DEMOGRAPHICS: The mean bone mineral density of each active duty group is seen in table 4.

MENSES	n=	BMD PA SPINE	S.D.	BMD FEMORAL NECK	S.D.
Amenorrhea	3	1.212	.054	0.993	.104
Oligomenorrhea	4	1.238	.085	1.020	.200
Late Menarche	14	1.191	.104	0.993	.139
Lt Menarc + Amen	1	1.376		1.170	
Lt Menarc + Oligo	3	1.214	.091	0.954	.082
Abnl Menses	25	1.211	.098	0.999	.136
Inj Medroxyprogest.	29	1.241	.14	1.045	.16
Eating Disorders	8	1.287	.191	1.136	.179

Table 4: Mean bone mineral density of subjects in each group. All groups exclude anyone on birth control pills or progesterone-only agents, and each group includes subjects with only that particular variable. All menstrual groups exclude all subjects with an eating disorder, and the eating disorder group excludes anyone with menstural irregularities. The amenorrhea (Amen), oligomenorrhea (Oligo), and late menarche (Lt Menarc) groups include subjects with those particular irregularities in isolation. The Lt Menarc + Amen or Oligo are groups which possess both late menarche and amenorrhea or oligomenorrhea respectively. The Abnl Menses group includes all subjects with irregular menses.

ONE VARIABLE: The affect of one variable on bone mineral density was examined by comparing each group above with the control group. There was no significant difference between the BMD of the groups in table 3 and the controls, using p<.05 as indicating significance. Each group was then examined after equal numbers of age, weight, and race matched controls were used for analysis of bone mineral density of the lumbar spine L2-L4 and femoral neck. Again, there was no statistically significant difference between the subjects and controls. An analysis of variance using the 3 covariates of age, race, and BMI was used to see if there was a difference in BMD between: women who had abnormal menses and those that did not; those that had an eating disorder and those that did not; and those that fit into any of the groups of interest compared with controls. This allowed us to look at the relationship between the variables of age, race, BMI, and bone mineral density and take those variables into account along with menstrual status or eating disorder status. There was no significant difference between the groups tested.

TWO VARIABLES: There were 11 subjects who had both an ED and MI. Of those 11 subjects, 2 were on BCPs and 5 were on injectable medroxyprogesterone leaving only 4 subjects who were not on any hormonal birth control. There were 4 other ED subjects whom were pregnant and 4 who had hysterectomies who were not included in our analysis.

There were 29 subjects who were both AR and had MI. Of the 29 AR subjects, 7 were on BCPs and 7 were on injectable medroxyprogesterone leaving only 15 subjects who were not on any hormonal birth control. The characteristics and bone mineral densities of the 4 women with both an ED and MI and the 15 women who were AR and had MI are listed in table 5.

ID	GROUP	MENSES	AGE yr.	WT. Lbs.	HT. In.	BMI k/m^2	L2-L4 g/cm^2	F. NECK g/cm^2
1	SITED	Lt Menarc	25	195	69	28.8	1.19	0.926
2	SITED	Oligo	46	200	72	27.1	1.435	1.10
3	EDNOS	Lt Menarc	42	165	69	24.4	1.510	1.195
4	SITED	Amen	26	207	69	30.6	1.204	1.062
5	AR	Prm Amen	36	140	68	21.3	1.394	1.014
6	AR	Lt Menarc	39	139	66	22.4	1.769	1.523
7	AR	Prm Amen	32	200	64	34.3	1.406	1.091
8	AR	Lt Menarc	22	128	64	21.9	1.140	1.170
9	AR	Oligo	24	130	62	23.8	1.111	1.075
10	AR	Oligo	21	105	60	20.5	1.247	0.958
11	AR	Oligo	26	105	67	16.5	1.429	1.146
12	AR	Prm Amen	36	132	62	24.1	1.066	0.858
13	AR	Oligo	19	140	66	22.6	1.053	0.959
14	AR	Oligo	18	110	60	21.5	1.042	0.869
15	AR	Lt Menarc	19	133	67	20.8	1.123	1.123
16	AR	Amen	23	176	66	28.4	1.363	1.145
17	AR	Lt Menarc	41	154	67	24.1	1.111	1.033
18	AR	Lt Menarc	26	125	62	22.9	1.165	0.871
19	AR	Oligo	24	167	67	26.2	1.174	0.906

Table 5: Characteristics and absolute BMD values of the lumbar spine and femoral neck for the active duty subjects who had both an ED and MI or were AR and had MI. For the control subjects, the mean BMD for the PA spine was 1.249 ±.116 g/cm^2 and for the femoral neck 1.011 ± .119 g/cm^2. Abbreviations are as follows: Lt Menarche = Late Menarche; Prm Amen = Primary Amenorrhea; Amen = Amenorrhea; Oligo = Oligomenorrhea.

THREE VARIABLES: Because our subject numbers are small, looking only at statistical significance may be misleading regarding the clinical significance of the BMD. For the purposes of looking at the full triad, we identified any subject with a BMD of either the lumbar spine or the femoral neck of one standard deviation below the mean of the normal control group (osteopenia). Of the women who had both an ED and MI, none of the

subjects not on hormonal birth control had a BMD $\geq$1.0 S.D. below the normal control group; however, 2 subjects on injectable medroxyprogesterone and 1 subject on BCPs had a BMD $\leq$1.0 S.D. Of the women AR and with MI not on hormonal birth control, there were 7 women with a BMD $\leq$1.0 S.D.. There was also 1 woman on BCPs and 1 woman on injectable medroxyprogesterone who was AR and had MI with a BMD $\leq$1.0 S.D.

One of our subjects with an ED should be mentioned separately because her femoral neck BMD is significantly lower (0.795 g/cm^2) than the control subjects. Her case was not included in the one and two variable BMD results above, because she had been undergoing treatment in an attempt to become pregnant and became pregnant just prior to her scheduled DEXA. Her DEXA was not done until 3 months after her pregnancy. In order not to skew the above results with other compounding factors, we chose to report on her case separately.

FEMALE ATHLETE TRIAD SUMMARY:

Using BMD $\leq$1.0 S.D. of the mean of the controls, and excluding those women on hormonal birth control:
ED + MI + BMD $\leq$1.0 S.D. = no women (0%)
AR + MI + BMD $\leq$1.0 S.D. = 7 women (1.7%)

Using BMD $\leq$1.0 S.D. and including all women:
ED + MI + BMD $\leq$1.0 S.D. = 3 women (0.7%)
AR + MI + BMD $\leq$1.0 S.D. = 9 women (2.1%)

Using p<.05 for a significant difference between subjects and controls for BMD with or without hormonal birth control: No subjects had the full triad.

DISCUSSION:

Active duty Army female soldiers participate in a great deal of physical activity and are under pressures to maintain certain weight standards, a passing performance on their APFT, and are expected to perform comparably to their male counterparts in their duty station. These requirements are critical to continuing their career in the military and failure to meet any of these requirements, will directly affect their vocational and financial well-being. Besides the pressures active duty soldiers are under to remain employed, they are also under the pressures of being an army soldier, to include; deployments, field time, heavy physical labor, frequent moves, and family pressures associated with such tasks. Females in particular, also experience the same societal pressures to achieve the " ideal physique" that their civilian counterparts do. The fact that a female army soldier experiences such pressures on a daily basis, supports that they are at risk for at least certain components, if not all aspects, of the *female athlete triad.*

The results of our study support the fact that female soldiers in the army, are indeed at risk for components of the *female athlete triad.* Part I of the study looked at the prevalence of eating disorders in our population. An 8% prevalence rate of eating disorders was found in the 423 soldiers who participated, which falls within the range reported in the literature. A significant number of our subjects admitted to behaviors which were suggestive of a DSM IV diagnosis, but yet did not meet DSM IV criteria due to the intermittent nature of their behaviors. This group of subjects clearly described performing their behaviors in association with an event from which they felt significant pressure. For those subjects, we defined a category called a Situational eating disorder (SITED), as we felt that the behaviors which they performed during their times of stress were too significant to ignore. It was clear from our results, that the pressure which subjects felt, correlated with the group within which they fell i.e. ED felt much greater pressure than AR, who felt more than the NEGATIVE group (table 3).

Self-reported questionnaires have been criticized in the literature due to the dependence on the honesty of the participant. It has been mentioned that younger individuals may answer more accurately than older athletes due to their potential naivete to all the pressures and consequences of not fitting the "desired" model. Such suggestions however, have not been validated. Self-report measures primarily assess attitudes and behaviors consistent with those exhibited by individuals with eating disorders.[56,91] Rosen and Poplawski,[57] tested the validity of a self-report questionnaire with external information and written eating and exercise diaries and found that with the exception of drastic weight control behaviors, results were positive for the validity of self-report questionnaires. In 1993, Sundgot-Borgen did one of the first studies to define eating disorders in athletes using both a survey and a clinical interview and examination.[50] She remarkably interviewed 193 elite athletes consisting of all of her defined at-risk and control non-athletes, and at-risk and controls athletes. From the EDI screening study, 22% of the athletes and 26% of the nonathletic controls were classified as being at-risk. After the interview, 89% of the athletes but only 20% of the non-athletes actually met the criteria for an eating disorder. On the

EDI, the athletes tended to underreport both the use of certain pathogenic weight control methods and eating disorders, whereas, non-athletes more correctly reported the use of pathogenic weight control methods and overreported the prevalence of eating disorders. Bingeing was overreported by athletes in the survey compared to the interview. She points out that the loss of control is not experienced by everyone that reports bingeing. This loss of control can be better evaluated by interviewing the subject than by interpreting self-reported information. Her study supports the importance of a clinical interview in determining the significance of the EDI, as Garner[91] recommends.

In our study, the EDI was used as an initial screening tool and individual interviews were done on anyone who met our "at-risk" screening criteria to rule out false positives and ascertain whether they met the diagnostic criteria for an eating disorder. A limitation of this study is that not all women were interviewed, therefore our true false negative rate was not determined. Of the women that we did screen however, only 50% of them actually met the diagnostic criteria for an eating disorder, therefore we feel confident that the number of false negatives are few. Another fact supporting the notion that our false negative rate is low, is the significant differences between ED group, the AR group, and the NEGATIVE group. There is a nice progression of the extent to which the different groups exercised, felt dissatisfied with their weight, felt pressure about their weight, scored on the DT, B, and BD subscales, and the total EDI scores for both the 8 and 11 subscales. The ED group was significantly greater on all of the variables, the AR group second and the NEGATIVE group the lowest. Of interest, is that our subject population was much older and weighed a great deal more than most studies looking at the adolescent and young adult athlete. In fact, the ED group had the highest BMI of all groups, which could explain the extreme measures they undergo to pass their weight requirement. This supports the idea that our military population of females have similar risk factors within their environment as do younger athletes in their competitive athletic environment. As discussed earlier, the pressures that the military population has, regarding their weight and performance on their APFT and in their duty station, remains constant throughout their career.

A second population, which we were able to evaluate using the EDI only, was a group of 310 ROTC cadets. Due to time constraints of their training schedule, we were not able to have them participate in a clinical interview, or Parts II or III. The ROTC cadet subjects who participated in the EDI did so on their initial day of camp, and therefore, their answers should reflect their behaviors and attitudes outside of the training camp environment. This population reflects a population of female college students who participate in a varying degree of military training and physical fitness, depending on the region of the country in which they do their academic training. Comparing the ROTC cadet's answers on the EDI questionnaire with the active duty soldier population, the ROTC cadets were significantly younger and weighed less. They also had much lower mean scores on the DT, B, and BD subscale scores than did the total group of active duty soldiers. When looking at what percent of participants would have met the screening criteria for an interview, 20% of the ROTC cadets met the criteria compared to 33.6% of the

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active duty group. The 20% of ROTC cadets who did meet the screening criteria for an interview, had a significantly higher DT, B, and BD score than did the remainder of the cadets who did not meet the screening criteria. There was no significant difference between the reported ideal body weight and the exercise intensity between the two groups.

Regarding menstrual cycles in active duty females, amenorrhea prevalence rates of 3.4%-66% have been reported compared to 2%-5% in the general female population.[15-21] The prevalence rates of amenorrhea, oligomenorrhea, and menarche older than age 14 in our population is 8.5%, 5.7%, and 12% respectively. Of the 12% of subjects with menarche older than age 14, 31% (3.8% of total subjects) could be classified as having primary amenorrhea. Many of our subjects however, experienced amenorrhea or oligomenorrhea as a result of the use of injectable medroxyprogesterone and a few with BCPs. Studies looking at the association between bone mineral density and menstrual cycle changes, exclude any subjects on hormonal birth control. Because we took all-comers for our participants, a large number of our subjects were excluded for evaluation of bone mineral density due to the use of hormonal birth control. Of the 100 women who fell into the MI category, 32 women (32%) were on hormonal birth control. Excluding all women on hormonal birth control in our population, the prevalence rate of amenorrhea, oligomenorrhea, and menarche older than age 14 decreased to 2.1%, 3.3%, and 9.2% respectively. A total of 3 women each, had amenorrhea and oligomenorrhea in addition to menarche older than age 14.

The 2.1% prevalence of amenorrhea seen in our population is a bit lower than that reported in the female athlete population, however, as pointed out by other authors, the prevalence varies based on the definition used.[16,74,79] We used a rather generous definition for amenorrhea, including women who missed an equivalence of the length of 3 of their usual cycles. Had we used a more conservative definition, our prevalence rate may have been even lower. Another factor, which may have affected our prevalence, is the fact that we only looked at the last 2 years to diagnose our subjects. We did not evaluate women with a history of menstrual irregularities further back than 2 years. Had we evaluated all women with a history of menstrual irregularities in their military career, our results may have been very different. A third factor which makes the prevalence of amenorrhea in our population difficult to compare to other studies with athletes in the literature, is the type of exercise. Our population tends to be involved in a multitude of different exercises including carrying heavy loads, jumping, marching with rucksacks weighing up to 35 lbs., running, and calisthenics, to name a few. We did not see the extremes of one particular exercise as seen in competitive athletes. On the other hand, the prevalence of cessation of menses during basic training in a subset of subjects was 67% which is similar to that reported in the literature.[53]

The number of subjects not on hormonal birth control that had 2 parts of the triad, to include an eating disorder and a menstrual cycle irregularity was small. Only 1% of subjects had the first 2 parts of the triad, and 3.5% were both at risk for an eating disorder and had a menstrual cycle irregularity. If we address those who had menstrual

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irregularities as a result of the use of injectable medroxyprogesterone or BCPs, as well as had an ED or were AR, our numbers increase to 2.6% and 6.9% of subjects respectively.

Part III of our study addressed bone mineral density and the prevalence of the full *female athlete triad*. The number of subjects that we found with both an ED and MI was small. Comparing BMD of the subjects with 1 and 2 variables of the triad with matched and unmatched controls using paired t-test and analysis of covariates showed no significant difference between BMD of the subjects and the controls. Because there were only 4 subjects who had an eating disorder and MI we decided to look at the absolute value of their BMD and determine whether any of the subjects had reached a BMD which was –1.0 S.D. of the controls. In this way, we attempted to look at the BMD from more of a clinical aspect, since a BMD of >1.0 S.D. below that of the mean of the young adults is defined as osteopenia. Using this method, there still was a 0% prevalence of females which had the full triad who were not using hormonal birth control, and a 0.7% prevalence in those females who were using hormonal birth control. Of those women at risk, 1.7% had the full female athlete triad not using hormonal birth control. A question arises whether the loading activity that army soldiers do, has a protective affect on the bone. The majority of subjects we worked with were in units that did a great deal of road marches up to 10 miles carrying up to a 35 lb. backpack. They also frequently jump out of heavy equipment, do jumping jacks as part of their physical fitness training, along with lifting heavy loads, much of which has been shown to positively affect BMD.[98,99]

Whether the triad is unique to athletes has been reexamined. Sundgot-Borgen[47] used the EDI to identify the extent to which college age subjects had a preoccupation with weight and tendencies toward eating disorders. She found no significant difference between college athletes and non-athletes when comparing the total number of EDI subscale scores or the DT subscale score. Warren et. al[51] and Weight and Noakes[100] were not able to support the notion that athletic participation invariably increased a woman's risk for developing disordered eating. Davis et. al.[90] argue that sport/exercise is an integral part of the pathogenesis and progression of anorexia nervosa as they found that 78% of hospitalized anorexia nervosa patients interviewed engaged in excessive exercise, 60% were competitive athletes prior to the onset of the disorder, 60% reported sport or exercise pre-dating dieting, and 75% claimed that as their food intake and weight decreased, their physical activity steadily increased. Evident from the literature is that the term "athlete" takes on many different meanings in each population studied. Numerous sports have been evaluated for their propensity to induce abnormal eating behaviors in female athletes. Those sports which emphasize leanness have been found to have a higher prevalence of ED[47,50]. The population used in this study is not considered the "traditional" athlete, yet female army soldiers do a great deal of physical activity and are in a "sport" that emphasizes leanness.

This study attempted to determine the prevalence of the full *female athlete triad*. Such a prevalence is not known as studies looking at the triad prevalence have, by history, proven to be very difficult. We attempted to look at the prevalence of the *female athlete*

triad in a population in which no component of the triad has been studied. This study has the following limitations: only subjects with abnormal eating behaviors and menstrual cycle irregularities in the last 2 years were studied; subjects with histories of eating disorders or menstrual cycle irregularities were not studied; all subjects were not interviewed and the subjects which did receive an interview were chosen based from their answers on the EDI, therefore relying on the accuracy of their self-report; there was a small sample size for BMD measurements for the final triad, therefore significance of their BMD values is hard to determine; and our subjects are from 8 different selected units, so we much question whether our sample group is representative of all females in the army. The strengths of this study are: we did not select our subjects based on whether they had one of the desired components of the triad, but rather achieved high participation rates (>90% for 7/8 units) in each unit in an attempt to get a more accurate representation of female soldiers; we interviewed the subjects which reported at-risk behaviors; all interviews were done by the same board certified psychiatrist, and all gynecologic examinations and diagnoses were performed by 2 board-certified gynecologists; we had a large sample size at the beginning of study; we were able to recognize a potentially significant and harmful form of eating disorder which we defined a SITED.

This study brings up a number of unanswered questions as well as recognizes potentially medically harmful entities in female army soldiers. In order to look more at the significance of the female athlete triad, a much larger study which is allowed a great deal more time is needed. The affect of a past history of eating disorders and amenorrhea and oligomenorrhea on bone mineral density and the incidence of stress fractures in this population also needs to be explored in the female soldier population. The bone mineral density of male and female soldiers should also be compared to determine if there is a certain bone mineral density in this population which leads to stress fractures to account for the higher rate of stress fractures in women.

The potentially harmful medical consequences of eating disorders are well-documented. An 8% prevalence of eating disorders in our population, despite the fact that the effect on bone mineral density needs to be further explored is enough evidence to advocate that further action is needed to address this problem in military females. What is unique about military women, is that they face weigh-ins, and APFT tests on a regular basis. It was very clear from this study, that many women report these events as times of high pressure, engaging in behaviors of abnormal dietary behaviors and exercise prior to these events. The question must be asked as to whether we are producing eating disorders by the types of pressures put on this population, and whether or not this is the best approach to getting women and men into shape for the military. If such pressure leads to potentially medically harmful behaviors, then should the approach used with this population be modified? The challenge becomes, finding the best approach to use for a soldier or athlete to optimize their performance, yet minimize the development of non-productive eating and dieting behaviors. The 1992 and 1997 American College of Sports Medicine Call to Action on the *female athlete triad* needs to be carried over to the military

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environment. Education about the problem needs to be developed in the way of brochures, slide series, videos, and speakers. Such education needs to be extended to all female soldiers, their chain of command, Master Fitness Trainers, and military physicians. A positive body image needs to be advocated and health, rather than weight, needs to be emphasized. Rather than a generic weight requirement for all races and duty assignments, perhaps the demands of the female soldier's duty assignment should be further explored and determine what body type would better handle the physical labor required in their particular duty assignment. Finally, we want to re-emphasize that further research is definitely needed in this area. After all, the female force in the United States Army makes up 14% of all active duty army soldiers.

CONCLUSIONS

Components of the female athlete triad do exist in military women. Out of a sample size of 423, 8% of women had an eating disorder. Of those women not on hormonal birth control, 2.1% had amenorrhea, and 0% had the full triad. Further work still needs to be completed on bone mineral density data from this study and in future studies to further explain the results.

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